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MUNICIPAL OWNERSHIP IN GERMANY

PART I. THE STREET RAILWAY

In all of the more essential matters the experience of Germany with the twofold policy of municipal ownership and severe restrictions upon public-service companies has been a repetition of the experience of Great Britain. The spirit of municipal ownership in Germany, as in Great Britain, has made the public more intent upon imposing all kinds of restrictions upon the public-service companies than upon the securing of services that shall be efficient, abundant, and reasonable in price. In the case of the horse railway it led to an exaggerated apprehension of inconvenience and danger to foot passengers and vehicles.¹ Scarcely had that apprehension been allayed when the desire to pre-empt the field, or to reserve it for future municipal activity, again increased the difficulty of obtaining charters.² In the case of the electric street railway, the spirit of municipal ownership enabled those who opposed the overhead wire from æsthetic desires to become an important factor in the forces that compelled the firm of Siemens & Halske to discontinue their efforts to perfect the electric street railway.³ "Born in Germany," to use a common German expression, the electric street railway had to "emigrate" to the United States, subsequently to return to the place of its birth as an industry "ready-made." In the case of the horse railway, the electric street railway, and the electric light, the spirit of municipal ownership has put into public-service company charters such onerous restrictions upon profits that the development of each one of those public-service industries has been either temporarily or permanently retarded. Finally, in Germany as in Great Britain, the spirit of municipal ownership has acted always and solely as a check upon industrial progress; it has contributed nothing either to the establishment of new industries or to the advancement of industries already established.

¹ K. Hilse, *Verstädterung der Strassenbahnen*, p. 6.

² *Ibid.*

³ *Elektrotechnische Zeitschrift*, August 23, 1894, p. 468: Siemens & Halske trade review of 1893.

The establishment of the gas-lighting industry in Germany was the work exclusively of private individuals, notably of Messrs. Unruh, W. and Ph. O. Oechselhäuser, L. A. Riedinger, W. Nolte, and Th. Weigel.⁴

Toward the establishment of the horse railway the municipalities contributed nothing whatever. In 1889 sixty-two German cities had street railways. Only four street railways had been built by cities; two of them had been sold at a loss shortly after building, and a third had been leased to a company, for the protection of the city treasury.⁵

In the field of electric street-railway building one finds the same record of failure. At the beginning of 1903 there were in Germany 1875 route-miles of electric street railway. Thereof only 309 route-miles had been built by cities.⁶

In the field of electric lighting municipal ownership shows the same record of failure. Even for some years after the electric-lighting industry was being introduced into Germany by private initiative, as an industry that had been "ready-made" in the United States, the German cities would not touch it, with some minor exceptions, such as Metz.⁷

There is but one exception to the record of municipal failure in the field of initiating new industries; and that exception is in the field of public water supply. With few exceptions, the water-works of Germany have been built by the cities and towns. In this field the cities showed power of initiative, because the power to compel every householder to become a customer removed the possibility of financial loss⁸

The condition upon which charters shall be granted is left to the discretion of the cities; there is no law covering the subject.

⁴ C. Hoeffner, in *Die deutschen Städte, geschildert nach den Ergebnissen der ersten deutschen Städteausstellung zu Dresden in 1903*, p. 199.

⁵ K. Hilse, *op. cit.*, pp. 15, 16, and 60.

⁶ H. Grossman, *Die kommunale Bedeutung des Strassenbahnwesens*, p. 270; and Dr. Wiefeldt, in *Die deutschen Städte*, p. 183.

⁷ Dr. Wiefeldt, *loc. cit.*

⁸ *Ibid.*

A common condition, in the case of street railways, is that the roadbed shall pass to the city, free of cost, after the lapse of, say, forty or fifty years. Rather commonly is added a franchise tax, which sometimes consists of a fixed annual sum per mile of track, at other times of a certain percentage of either the gross or net receipts. The taxes levied upon the street-railway companies for keeping in repair and cleaning the streets invariably are out of proportion to the use which the companies make of the streets. Sometimes the companies are compelled to purchase their current from the municipal-light plant. Frequently the companies are compelled to carry free of cost certain city employees. Occasionally one finds a city whose main purpose it is to promote the building of street railways; but in the vast majority of cases the cities aim to make money by the sale of their franchises, rather than to secure to the public the benefit of street-railway services that shall be efficient, abundant, and reasonable in price.⁹

The effect of the foregoing policy has been to restrict street-railway building, first in the era of horse railway and subsequently in the era of city electric street railways. The era of electric suburban railways and of interurban railways scarcely has dawned in Germany.

Had Germany, in proportion to its population living in cities of upward of 50,000 people, been as well supplied with horse street railways in the year 1890 as the United States had been thus supplied in the year 1880, it would have had 1,430 route-miles of horse street railway in its forty-seven cities with a population of upward of 50,000 people.¹⁰ As a matter of fact, it had less than

⁹ K. Hilse, *op. cit.*, p. 44, 24, 63, and 64; A. Liebmann, in *Illustrierte Zeitschrift für Klein- und Strassenbahnen*, January 16, 1903; and Mr. Vellguth, *ibid.*, January 1, 1901.

¹⁰ *United States Census*, 1890: "Transportation by Land," Part I.

	UNITED STATES, 1880		GERMANY, 1890	
	Route-Miles of Street Railway	Total Population	Route-Miles of Street Railway	Total Population
Cities of more than 50,000 People.....	1,584	8,699,000	800	7,960,000
Cities of less than 50,000 People.....	466	?		?

850 route-miles of horse street railway, distributed among some sixty-five cities.¹¹ Had those German cities which in 1890 had upward of 50,000 inhabitants been as well supplied with street railways in 1890 as were the corresponding American cities they would have had a total of 1990 route-miles of street railway. The foregoing comparisons between the street-railway facilities of the United States and Germany leave out of account the fact that there were in the United States, in cities of less than 50,000 people, 466 miles of street railway in 1880, and 2,578 miles in 1890. They are, therefore, unduly favorable to Germany.

In 1879, in the grounds of the Berlin Industrial Exposition, Messrs. Siemens & Halske installed and operated the first electric railway. Upon the strength of the success achieved, Messrs. Siemens & Halske in 1880 and the subsequent years repeatedly applied for permission to erect and operate electric elevated railways in Berlin. All of the requests were rejected by the public authorities. In 1882 Messrs. Siemens & Halske built an experimental overhead-wire electric railway from Charlottenburg to the Spandauer Bock. The current was taken from the overhead wire by means of a small so-called contact-wagon, which ran along the wire. In 1884 and 1883, respectively, they built from Frankfort on the Main to Offenbach, and in the northern part of Ireland, from Portrush to Bush Mills, two electric railways which remained in operation as built for upward of ten years. For carrying the current those railways made use of a rail attached to posts erected alongside of the railway track.¹² In 1899 Messrs. Siemens & Halske built the Budapest underground electric railway. Ultimately they invented a stirrup or loop, which is in use today upon several electric street railways in Germany, in competition with the "trolley wheel," an American invention.¹³ These facts justify the statement that Messrs. Siemens & Halske would have achieved the electric street railway, had they been properly encouraged by the German public authorities. But the

¹¹ K. Hilse, *op. cit.*, p. 15.

¹² *Illustrierte Zeitschrift für Klein- und Strassenbahnen*, June 15, 1904.

¹³ *Eisenbahntechnische Zeitschrift*, January 18, 1905.

public opposition to the overhead wire, and the great difficulty of raising capital for venturesome enterprises under the burdensome and comparatively short-lived German franchises, defeated Messrs Siemens & Halske's efforts.¹⁴ After the death of Mr. Werner von Siemens, the experiment of the electric railway was abandoned completely in Germany. The work was taken up in the United States, and in 1890, the "trolley" electric street railway was introduced into Germany as an industry "ready-made." For a number of years after 1890 the electric street railway in Germany, in almost all of its details, continued to be patterned after American models.¹⁵

In the years 1891 to 1893 the electric street railway made little progress in Germany. The terms upon which franchises could be had were such that it was practically impossible to raise money for a venture of uncertain financial outcome. By the year 1893, however, the experience of the United States as to the financial results of trolley lines was sufficiently conclusive to persuade leading German financiers to establish trolley lines on a moderate scale in Germany. From 1896 to 1900 construction was fairly rapid; but since 1901 it has been rather moderate.¹⁶ In the German technical street-railway journals one occasionally finds the statement that at present there is little further scope for electric street-railway building, since practically all of the cities with more than 40,000 inhabitants have been supplied with street

¹⁴ Compare *Elektrotechnische Zeitschrift*, August 23, 1894, p. 468.

¹⁵ *Illustrierte Zeitschrift für Klein- und Strassenbahnen*, November 16, 1903, p. 1067; *Elektrotechnische Zeitschrift*, June 6, 1905, Dr. R. Haas; G. Schimpff, *Die Strassenbahnen in den Vereinigten Staaten*, in the preface; and *Zeitschrift für Kleinbahnen*, 1900, p. 113, Mr. L. Baumgardt.

¹⁶ *Elektrotechnische Zeitschrift*, February 7, 1901, and July 13, 1905.

	Number of Cities and Districts Sup- plied with Street Railways	Total Route Mileage	Total Track Mileage
1891	3	?	?
1893	11	?	?
1894	21	?	?
1896	42	364	535
1900	99	1,793	2,659
1904	140	2,369	3,544

railways!¹⁷ The attitude of the mind that prompts such statements shows how the spirit of adventure has been impaired by onerous and short-lived franchises.

In October, 1904, there were in Germany 144 cities and districts that had street railways. In other words, there was a street railway in very nearly each one of the seventy-one cities that had 50,000, or more, inhabitants; a street railway in about 40 to 45 per cent. of the cities having between 20,000 and 50,000 inhabitants; and occasionally there was to be found a street railway in a city of less than 20,000 inhabitants.¹⁸ The reader will recall that in the United States, in 1902, every city of 15,000 and more inhabitants had a street railway; that 76 per cent. of the places of 9,000 to 10,000 inhabitants had street railways, and that 41 per cent. of the places of 4,000 to 5,000 inhabitants had street railways.¹⁹ In other words, in the United States, in 1902, places of 4,000 to 5,000 people were about as well supplied with street railways as were places of 20,000 to 50,000 people in Germany in 1904.

In 1902, in not less than 95 per cent. of the cities of the United States having 50,000 or more inhabitants, the proportion borne by the street-railway track-mileage to the population ranged from one mile of track for each 700 people to one mile of track for each 1,800 people. In Germany, on the other hand, in 1903-4, in not less than 84 per cent. of the cities of 50,000 and more inhabitants the proportion in question was one mile of track for

¹⁷ *Elektrotechnische Zeitschrift*, June 29, 1905, Dr. R. Haas; *Illustrierte Zeitschrift für Klein- und Strassenbahnen*, January 16, 1903.

¹⁸ Census of 1900.

Cities of		Number	Aggregate Population
5,000 and under	20,000	864	7,585,000
20,000 and under	50,000	156	4,557,000
50,000 and under	100,000	38	2,554,000
100,000 and under	250,000	24	3,830,000
250,000 and under	1,000,000	8	3,404,000
1,000,000 and over	1	1,886,000

¹⁹ H. R. Meyer, *Municipal Ownership in Great Britain*, p. 87.

each 4,000 to 13,000 people.²⁰ In other words, judged by American standards, the Germans scarcely have begun to use the street railway for the purpose of decentralizing, or "suburbanizing," the people of the larger cities. This matter is the more serious, since in the German cities of 200,000 or more inhabitants the average density of population most commonly ranges from 22 persons per acre to 40 persons; whereas in the United States, in cities of corresponding size, the average density of population most commonly ranges from 12 persons per acre to 22 persons.²¹ Berlin, with its immediate suburbs, has an aggregate population of 2,600,000 people. The average density of population is 75 persons per acre; the street-railway track-mileage is one mile of track for each 5,600 people. Greater New York has an average density of population of 18 persons per acre; and one mile of surface street-railway track for each 3,500 people.

²⁰ *Twelfth Census of the United States, 1900, Vol. I; Census Bulletin, No. 7, 1904; Census Bulletin, No. 3, 1903; Elektrotechnische Zeitschrift, July 13, 1905; Eisenbahntechnische Zeitschrift, May 17, 1905; Statistisches Jahrbuch deutscher Städte, 1902; and Illustrierte Zeitschrift für Klein- und Strassenbahnen, January 16, 1903.*

CITIES OF 50,000 AND MORE INHABITANTS

ONE MILE OF STREET RAILWAY TRACK FOR	NUMBER OF CITIES	
	United States	Germany
Less than 1,000 people.....	5	0
Each 1,000 to 1,999 people.....	46	2
Each 2,000 to 2,999 people.....	10	2
Each 3,000 to 3,999 people.....	2	5
Each 4,000 to 4,999 people.....	0	14
Each 5,000 to 5,999 people.....	1	10
Each 6,000 to 6,999 people.....	0	6
Each 7,000 to 7,999 people.....	0	8
Each 8,000 to 8,999 people.....	0	2
Each 9,000 to 9,999 people.....	0	2
Each 10,000 to 10,999 people.....	0	4
Each 11,000 to 11,999 people.....	0	1
Each 13,000.....	0	1
Total number of cities.....	64	57

²¹ *Eisenbahntechnische Zeitschrift, May 17, 1905; and Census Bulletin, No. 7, 1904.*

UNITED STATES		GERMANY	
Persons per Acre	Number of Cities	Persons per Acre	Number of Cities
6-11	3	12-16	4
12-22	16	20-40	12
27	1	75	1

The city residents of Germany labor not only under the disadvantage of restricted street-railway facilities, but also, in many instances, under the further disadvantage of having to pay fares that are graded according to distance. Some years ago a number of street-railway companies adopted the uniform fare of 2.5 cents (ten pfennige); but a goodly proportion of them have returned to the system of graded fares. The preponderance of opinion in Germany at present appears to be that the uniform fare of 2.5 cents is unprofitable to the street-railway company—in other words, gives the public too much for its money. Among the companies that have abandoned the uniform fare, after trial, are the companies operating in Frankfort on the Main, Munich, Mannheim, Elberfeld-Barmen, and Mülheim on the Rhine. The municipal tramways of Düsseldorf²² also have abandoned the uniform fare.²³ The Berlin surface street railway is under a contract with the city to charge a uniform fare of 2.5 cents, but it is said that the company will build into the suburbs only upon a guarantee of certain earnings, this guarantee being given by the suburban local governing bodies.²⁴ The Berlin Elevated Railway charges a graded fare and its receipts per passenger carried average 3.1.²⁵

The city of Cologne²⁶ recently acquired the street railways and, after operating them a while, raised the charges for long-distance rides. The charges originally were 2.5 cents for distances up to 1.5 miles, and 3.75 cents for the maximum distance, 6.9 miles. The present charges are: 2.5 cents for 1.9 miles, 3.75

²² *Zeitung des Vereins deutscher Eisenbahn-Verwaltungen*, February 13 and June 22, 1904; and *Eisenbahntechnische Zeitschrift*, June 7, 1905.

	Population Served	Miles of Street Railway Track
Munich.....	550,000	93
Frankfort on the Main.....	390,000	60
Elberfeld-Barmen.....	330,000	83
Düsseldorf.....	270,000	128
Mannheim.....	146,000	27
Mülheim on the Rhine.....	40,000	14

²³ *Zeitung des Vereins deutscher Eisenbahn-Verwaltungen*, February 13 and

²⁵ *Ibid.*, September 24, 1904.

²⁶ Population, 450,000; track-mileage, 96 miles.

cents for 3.75 miles, 5 cents for 5.63 miles, and 6.25 cents for distances over 5.63 miles.²⁷

The city of Düsseldorf acquired the street railways in 1900 and, after operating them at a loss, substituted for the uniform fare the following charges: 2.5 cents for 2.44 miles, and 3.75 cents for 4.25 miles. After increasing the track-mileage, the city, in 1904, adopted the following scheme of charges: 2.5 cents for 1.56 miles, 3.75 cents for 3.19 miles, 5 cents for 4 miles, 6.25 cents for 4.75 miles, 7.5 cents for 6.38 miles, 8.75 cents for 7.19 miles, and 10 cents for 7.94 miles. It provided, however, that the charges from any point within the city to any point without the city should not exceed 3.75 cents.²⁸

One reason for the numerous failures of the uniform charge of 2.5 cents probably was that the companies and municipalities frequently gave special reductions to working-men and school children traveling at certain hours of the day, as well as to persons who bought season tickets. Another reason probably is that a uniform fare of 2.5 cents does not afford on the short-distance travel, adequate margin of profit, to cover the losses which must be incurred on the suburban lines until such time as the people shall have moved into the suburbs in sufficient numbers to make the suburban lines self-supporting. Ultimately suburban lines become feeders; but for the first years they are a drain. In Germany it is taking longer to teach the people to move into the suburbs than it took in the United States. One important reason for that difference between the two countries in question is that in the United States the horse-car line had begun the work of teaching the people to move to the suburbs, whereas in Germany the horse car had never developed beyond the point of being a means of communication between points within the city proper.

No doubt street-railway building would receive a considerable impetus in Germany if it should become possible to introduce a uniform rate of 3.75 cents. But the latter sum is beyond the

²⁷ *Eisenbahntechnische Zeitschrift*, June 7, 1905.

²⁸ *Zeitschrift für Transportwesen und Strassenbau*, September 10, 1904; and *Zeitung des Vereins deutscher Eisenbahn-Verwaltungen*, June 22, 1904.

means, or, at any rate, beyond the spending habits of the bulk of the German city-dwellers. Even a uniform rate of 3 cents might make possible a fairly rapid extension of the street-railway mileage. But there is no 3-cent coin; and that lack is felt to be an insuperable obstacle to the uniform 3-cent fare, as the public does not like to carry copper coins. Under the circumstances the graded fare is the alternative to the uniform 2.5-cent fare.

On the other hand, all experience teaches that, under the system of graded fares, the long-distance ride becomes too expensive for the daily use of the bulk of even the so-called middle classes. Decentralization of the population on a large scale can be achieved only under the system of a uniform fare adapted to the purse and the spending habits of the great mass of the people. For Germany that fare is 2.5 cents. If, therefore, the German municipal authorities were possessed of that wisdom and public spirit which so many of us are inclined to attribute to the public authority, be it state or municipal, those German municipal authorities long since would have abandoned the practice of treating street-railway companies as persons peculiarly fit for taxation. They would long since have gone over to the practice of taxing street railways as lightly as possible. They would also have given long-life franchises, free from the burdensome provision that at the expiration of the franchise the roadbed should pass to the city, free of cost. Under a liberal and enlightened policy of that kind, German investors and captains of industry would provide abundant capital willing to embark in street-railway ventures which for a number of years must of necessity be ventures yielding an inadequate return. The prospect of a large ultimate reward, which shall be one's own, and shall not go to the public authority or be shared with it, calls forth as much of the spirit of adventure—or of gambling, if you please—in Germany as it does in the United States. Witness the millions upon millions of German capital that were poured into the United States railways in the years following 1870; witness the millions that ever since have been poured freely into venturesome enterprises in almost all parts of the world.

PART II. ELECTRIC LIGHTING

Mr. H. Rathenau, who subsequently founded the German General Electric Company, introduced the electric light into Germany shortly after the Paris Electric Exposition of 1881. There co-operated with him the bank of Jacob Landau in Berlin, the bank of Gebrüder Sulzbach in Frankfort on the Main, and the Nationalbank für Deutschland in Berlin. Those persons formed a so-called "study company," for the purpose of testing the practicability of the electric light. They established the first trial plant in the printing establishment of Mr. W. Buexenstein. In May, 1883, they organized the German Edison Company, with a capital of \$1,250,000, to supply cities with electric light.²⁹

The first charter obtained by the German Edison Company granted rights for Berlin. The terms were: no monopoly rights; the city to receive 10 per cent. of the gross receipts, as well as 25 per cent. of the net receipts in excess of 6 per cent. on the capital investment; the company to set aside annually 2 per cent. of its gross revenue, until it should have established a renewal fund of 20 per cent. Should the city exercise its power to purchase the company's plant, the aforesaid renewal fund was to pass to the city without compensation to the company. The city was to have the right to purchase at any time after the lapse of ten years, on the payment of the "structural value" of the plant, plus an allowance of 50 per cent. if the company had been operating its plant for fifteen years. For each year by which the company had failed to be in operation a total of fifteen years, the 50 per cent. allowance was to be increased by 3.33 per cent. Contrariwise, for each year that the company should have been in operation in excess of fifteen years the 50 per cent. allowance was to be reduced by 3.75 per cent.; so that the city had the right to purchase at "structural value" at the expiration of twenty-eight years.³⁰ If one take into consideration the fact that the city would acquire free of cost the 20 per cent. renewal fund, the city had the right to purchase at structural value at the end of twenty-three years. The terms of the charter were burdensome, and necessarily

²⁹ H. Lux, *Die öffentliche Beleuchtung von Berlin*, p. 177. Mr. Lux issues the *Zeitschrift für Beleuchtungswesen*.

³⁰ H. Lux *op. cit.*, p. 345.

compelled the company to restrict its operations to the most profitable parts of the city. Though the company began operations in 1885, it was at the close of 1896-97 not yet supplying current in the principal manufacturing districts of Berlin.³¹

The franchise granted by the city of Berlin was fairly typical of German electric-lighting franchises, which generally are short-lived, often lapsing at the end of ten or fifteen years, call for considerable annual payments to the city, and reserve the right of the city to purchase the company's plant or to instal a municipal plant.³²

As in the case of the street-railway industry, so in the case of the electric-lighting industry, the result of the policy of granting only franchises full of burdensome provisions was to exclude Germany from all participation in the work of establishing the industry of the electric lighting of cities by means of central electric stations. In December, 1888, there were in operation in Germany only fifteen central electric stations,³³ as against 574 in the United States.³⁴ As late as 1896-97 there were in Germany only a little upward of 300 central electric stations; and those stations still confined themselves largely to the central portions of the cities, though the manufacturing establishments were largely located in the outlying portions of the cities. Even the resident sections of the very wealthy were, in some cities, entirely without the electric light in 1896-97.³⁵

When Messrs. Rathenau and associates concluded to introduce the electric light in Germany, that country was very well supplied with gas plants. In 1885 about 75 per cent. of the German cities with a population of 5,000 to 20,000 were supplied with gas plants.³⁶ At that time the electric light was commonly deemed "the light of luxury," which would find it difficult to compete with the gas light. There was also much doubt as to the distance

³¹ H. Lux, *Gas- und Elektrizitätswerke in Deutschland*, pp. 71, 81.

³² *Elektrotechnische Zeitschrift*, July, 1888, Heft 13, p. 328, Mr. O. v. Miller.

³³ *Ibid.*, September 16, 1901.

³⁴ H. R. Meyer, *Municipal Ownership in Great Britain*, p. 261.

³⁵ H. Lux, *Gas- und Elektrizitätswerke in Deutschland*, pp. 81, 85.

³⁶ *Ibid.*, pp. VC, F, and E.

that the electric current could be transmitted without such loss of current as would prove commercially prohibitive. These apprehensions were not allayed by the burdensome clauses commonly inserted in electric-lighting charters.

In 1891, at the Frankfort Electrical Exhibition, the *Allgemeine Elektrizitätsgesellschaft* drove the machinery in the factory of Mr. Oerlikon by means of power furnished by current transmitted over a long distance. That achievement made promoters and capitalists take much more kindly to investments in central electric stations. It came to be believed that stations supplying current for power as well as for light would be able to take up the competition with the gas plants.³⁷ In 1892-93 German promoters and capitalists took up seriously the building of central electric stations.³⁸

In September, 1906, there were in operation, in process of construction, and under consideration, 1,344 central electrical stations. On that date were entirely without central electric stations, or the immediate prospect of such stations, 32 per cent. of the cities ranging in population from 20,000 people to 49,999; 62 per cent. of the towns and cities ranging from 5,000 people to 19,999; and 59 per cent. of the places ranging from 2,000 to 4,999.³⁹

In 1902 there were in the United States enough central electric stations to give one such station to each one of 90 per cent. of the places of 5,000 and less than 25,000 people, as well as one station each to 75 per cent. of the places ranging in population from 1,000 persons to 5,000.⁴⁰

In the period from 1881 to 1891, while Germany was doing practically nothing in the field of electric lighting in which one had to have a municipal franchise, it was exceedingly active in the field in which one could operate under complete freedom from

³⁷ *Ibid.*, p. 2.

³⁸ *Elektrotechnische Zeitschrift*, January 12, and July 20, 1905, and subsequent issues; and *Die deutschen Städte*, p. 240, Professor W. Kubler.

³⁹ *Elektrotechnische Zeitschrift*, Heft 42, 1906.

⁴⁰ H. R. Meyer, *Municipal Ownership in Great Britain*, p. 261.

municipal intervention or municipal consent. In November, 1888, Mr. Werner von Siemens was able to state, in an address delivered upon the occasion of the annual convention of German electrical engineers, that the electric light was in all but universal use in certain branches of manufacturing, notably the weaving and spinning industries. He added that in certain branches of industry practically every new plant was being equipped for electric lighting.⁴¹ In 1894-95 there were in operation, in 517 cities and places, upward of 4,776 private electric light plants, many of them being so-called block stations. In each one of those 517 cities and places gas light was available.⁴²

The problem of applying electricity to the uses of man was taken up in Germany under conditions that were ideal, so far as the successful and rapid solution of that problem depended upon the presence of men of unsurpassed mechanical genius, of men of great power of organization, and of men ready to stake vast sums of money upon the outcome of the venture. As a mechanical and electrical engineer Mr. Werner von Siemens was unsurpassed in his lifetime. A few years ago Harvard University conferred an honorary degree upon Mr. Steinmetz, of the American General Electric Company. President Eliot upon that occasion denominated Mr. Steinmetz the first electrical engineer of America, "and therefore of the world." Mr. Steinmetz had been born and educated in Germany, and had come to the United States after he had grown to manhood. Mr. Rathenau, who introduced the electric light into Germany, subsequently became the founder and managing director of the German General Electric Company. In 1904 that concern had a capital of \$28,500,000 and a reserve fund of \$8,000,000, and was employing 27,500 persons.⁴³ In 1900 there were several electric companies employing 10,000 men each, and controlling a capital of \$25,000,000 to \$40,000,000 each.

From the beginning there was the closest co-operation between engineer, organizer, and banker. The firms which began as

⁴¹ *Elektrotechnische Zeitschrift*, Heft 21, 1888.

⁴² H. Lux, *Gas- und Elektrizitätswerke in Deutschland*, pp. 8, 9.

⁴³ *Eisenbautechnische Zeitschrift*, January 18, 1904.

manufacturers of electrical machinery and apparatus quickly developed into builders and operators of central electric stations and electric street railways. As the public at large would not go into the latter ventures, the manufacturers of machinery had to educate the general public to have confidence in the new industries. They built central electric stations and street railways with their own capital, or with the capital of offshoot companies; and after giving those enterprises established records as dividend-paying companies, they sold them, or an interest in them, to the general public. Thus the German General Electric Company in 1903-4 was interested to the extent of \$17,000,000 in central electric stations, electric street railways, and other ventures.⁴⁴ In the period from 1884 to 1900, under the leadership of the Siemens & Halske companies, General Electric companies, Schuckert companies, Union companies, Helios companies, Lahnmeyer companies, and Kummer companies, the German people were induced to invest some \$500,000,000 in the various so-called electrical industries. The greater part of that investment was made in 1892 to 1900.

The public policy of granting charters or franchises on burdensome terms only, prevented German engineers and captains of industry from engaging in the building of central electric stations and electric street railways, until the American engineers and captains of industry had carried those industries through the tentative and wholly speculative stage to the stage of industries that were "ready-made." But in the field where one could operate without a franchise—that is, where unwise public opinion had created no artificial check upon German enterprise—the German engineers and captains of industry immediately took their proper place alongside of their American contemporaries. In that field they proved themselves possessed of inventive genius, power of initiation, and power of organization that were in no way inferior to the corresponding powers of their American contemporaries.

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⁴⁴ *Ibid.*